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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :
E03F 9/00

A1

(11) International Publication Number: WO 94/08105

(43) International Publication Date: 14 April 1994 (14.04.94)

(21) International Application Number: PCT/GB93/02007

(22) International Filing Date: 27 September 1993 (27.09.93)

(30) Priority data:
9220531.9 29 September 1992 (29.09.92) GB

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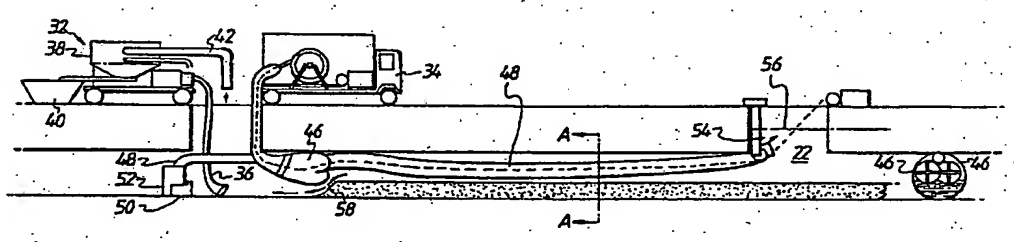
(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, LV, MG, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: IMPROVEMENTS RELATING TO THE CLEANING OF PIPELINES AND PASSAGEWAYS



(57) Abstract

The invention provides a method of removing detritus (12) from the bottom of an underground pipe (10) in which liquid flows. The method involves everting into the pipe and over the detritus two air filled tubes (46), the tubes (46) block the liquid flow and the liquid (14) builds up until a sufficient head (56) causes the liquid to be forced past the underside of the everting tubes at the everting faces at high velocity so as to erode and break up the detritus (12) which is swept away and can be sucked out of the pipe (10). Removal is progressive in that as the detritus (12) is removed from downstream to upstream, so the tubes (46) are progressively everted along the pipe (10). The detritus (12) may be pre-disturbed by a mechanical plough (24).

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Improvements Relating to the Cleaning of Pipelines and Passageways

This invention relates to a method of cleaning pipelines and passageways which carry fluent material such as effluent and sewage.

These pipelines or passageways frequently become restricted or blocked as a result of the deposit of solid material in the bottom of the pipeline or passageways. This solid material is commonly referred to as detritus and as it builds up in the bottom of the pipeline or passageway so the passageway becomes restricted or throttled and flow therethrough is reduced. It is desirable therefore to remove this detritus, from the point of view of enhancing the flow through the pipeline or passageway; there is a further circumstance in which the detritus removal is desirable and that circumstance is where the pipeline or passageway is to be repaired or re-habilitated by the application to the surface thereof of a lining tube.

It is now well established to apply lining tubes to reline underground pipelines or passageways where they have fallen into a state of disrepair, and the most popular methods for effecting this relining comprises the use of a "cured in place" system. In such a system, of which an example is set forth in UK Patent No 1,449,445, a tube which is flexible in nature and comprises or includes resin absorbent material, has the resin absorbent material soaked in curable synthetic resin and, whilst the tube is still flexible and the resin is uncured, the tube is forced by fluid pressure onto the surface of the underground pipeline or passageway. The resin is then caused to be cured by any suitable means such as heat or ultra-violet radiation and when the resin hardens, the result is that there is in position a rigid lining pipe which

not only repairs the pipeline or passageway surface, but also enhances the flow through the pipeline or passageway of the fluent medium.

This invention is however concerned with the removal of the detritus material, and the method can be practised in a pipeline or passageway which has to be relined or which has previously been relined, or the method may be practised simply where it is required to remove the detritus.

A known method for endeavouring to remove detritus comprises pulling a suction head along the pipeline or passageway and with the suction head is one or more water jet nozzles through which water is supplied to be fired onto the detritus in order to dislodge it so that the suction device can suck in the dislodged material.

Such an arrangement however in practice failed to function effectively. The true reason is not known, but it is believed that the water jets were not sufficiently strong to dislodge the material or the material was not sufficiently broken up to be drawn effectively into the suction side of the apparatus.

The present invention is concerned with approaching the problem of detritus removal from pipelines or passageways in a different manner.

In accordance with the invention in a general aspect thereof, detritus is removed from an underground pipeline or passageway by creating a flow of liquid adjacent the surface of the detritus to cause it to be broken away into a suitable size for removal for example by suction, said flow being created by inserting in the pipeline or passageway restrictor means so that in effect a venturi type throat is created

between the restrictor means and the detritus surface, and this is coupled with the application of a sufficient pressure to the liquid to force it through said venturi effect area.

The restrictor means may be moved progressively along the pipeline or passageway as the detritus is progressively removed.

Preferably, the restrictor means comprises tubes which are inserted in the pipeline or passageway and are inflated. It is preferred that two inflated tubes be used, these being located above the surface of the detritus, and the venturi effect being created in the space between the underside of the tubes and the detritus level.

Preferably, the said tubes are everted into the pipeline or passageway and the venturi effect is created adjacent the everting faces of the tubes.

The tubes in being inserted in this way also form a fluid flow stopping device enabling the build up of a body of the liquid of sufficient head to cause the liquid to flow through the venturi area at high velocity thereby to erode and disturb the detritus.

The disturbed detritus and the fluid in which it is entrained may be sucked from the pipeline or passageway by suction means and delivered for example to a hydro cyclone separator in which the detritus is separated out from the liquid, and the liquid is returned to the pipeline or passageway downstream of the venturi area. The liquid may be returned to the upstream end to add to said surcharge head by means of a return pipe and pump arrangement, the return pipe being supported by the restrictor tubes.

Over any given length of pipeline or passageway from which detritus is being removed, the method is progressive insofaras the restrictor tubes are everted from the downstream end whilst liquid flows from the upstream end and the detritus is eroded and loosened from the downstream end towards the upstream end.

Other suitable forms of restrictor means may be adopted, and preferably, prior to the creation of the high velocity flow in the venturi area, a disturbing plough is pulled through the detritus in order to pre-loosen same.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying diagramatic drawings wherein:-

Figs. 1, 2 and 3 are sectional side elevations illustrating the method according to the embodiment; and

Figs. 1A, 2A and 3A are sectional view through the pipeline or passageway during the respective stages of the operation illustrated in Figs. 1, 2 and 3.

Referring to the drawings, in Fig. 1 there is shown an underground pipeline or passageway (10) on the bottom of which is a deposit of detritus (12). The pipeline or passageway is shown in its normal flowing condition wherein liquid, typically water carrying sewage is illustrated by reference (14), and the water flow is generally speaking over the detritus as indicated by arrow (16) in a direction from right to left in Fig. 1. The water level is indicated by reference (18), and in the flowing condition shown, the water flow rate will be in the order of less than 60 centimetres per second.

It can be seen clearly from Fig. 1 and from Fig. 1A that the detritus deposit (12) a severe restriction for the pipeline or passageway (10). Indeed, when the detritus gets to such a level it becomes imperative that it be removed. This embodiment of the invention is concerned with the detritus removal and the explanation is given in relation to the removal of the detritus between two manholes (20) and (22) but it will be understood that the described method is used for the entire pipeline or passageway should it be required that the entir pipeline or passageway has to have the detritus removed therefrom.

The first step in the method involved the winching of a detritus plough (24) comprising a body and radiating plough arms along the pipeline or passageway (10) by the dragging of same there along using a winch (26) at ground level and a winch cable (28) connected to the plough (24). Fig. 1A shows the plough configuration in side view and the arms are clearly shown, and it will be understood that as the plough (24) is pulled along the pipeline or passageway, the arms and the skids (30) thereon penetrate and dislodge the detritus so that it becomes semi loose.

For the next stage of the operation, a cyclone separator unit (32) and pump vehicle unit (34) are used.

The purpose of the cyclone separator unit (32) is to suck, by means of a suction pipe (36), detritus which is loosened in the process and to suck the detritus and its carrying liquid into the cyclone separator (38) wherein the detritus is separated from the liquid and is dumped into a collection skip (40) whilst the liquid is returned through a return pipe (42) into the man hole (20). To enable the suction pipe (36) to perform this suction, the loosened detritus must be further acted upon by means of water flow to make the

resultant detritus and liquid sufficiently fluent to be drawn up the pipe (36) and in this connection the pump vehicle (34) is used. Vehicle (34) has downpipes (44) (there are two) which extend down into the manhole (20) and are turned with elbows into the end of the pipeline or passageway (10) as shown in Fig.1. From the Vehicle (34) flexible tubes are everted, by our under pressure through the pipes (44), and then out into the pipeline or passageway (10) in an everting manner as indicated at (46) in Fig. 2. Fig. 2A shows that there are two pipes (46) located side by side. They are inflated and everted using air under pressure so that the pipes (46) will in fact float on the liquid (14).

Fig. 2 also shows a water return pipe (48) which is connected to a pump (50) entrapped in a weir structure (52). The pump (50) draws water from the vicinity of the weir structure (52) and returns it along pipe (48) to the vicinity of manhole (22) as indicated by arrows (54).

Fig. 2 shows the process at the initial stage. The tubes (46) are being progressively everted so that in fact the tubes form a fluid flow stoppage device for liquid (14) and the liquid level therefore quickly builds up to level (56) as shown in manhole (22). A venturi throat (58) is created between the front undersid of the everting tubes (46) and the detritus surface, and in the throat the liquid flows at a high velocity in accordance with well known venturi principles. Indeed, the liquid velocity increases to the order of 1.8 metres per second in this area. This fast flowing liquid breaks away and dislodges the semi-loose detritus as shown, so that the detritus and liquid form a fluent suspension which can be drawn away by the suction tube (36). The everting tubes (46) in being buoyantly supported also support the water return pipe (48) and lift it to the top of the pipeline or passageway so as not to interfere with

the water flow. An extremely effective means of disturbing and removing the detritus is provided.

Fig. 3 and 3A simply show the process nearing completing completion and it will be seen that the detritus has been largely removed from the pipeline or passageway.

This method is suitably useable when the pipeline or passageway subsequently is to be lined using a cured in place lining system as described.

CLAIMS

1. A method of removing detritus (12) from an underground pipeline or passageway (10) by creating a flow of liquid (14) adjacent the surface of the detritus (12) to cause it to be broken away into a suitable size for removal for example by suction, characterised in that said flow is created by inserting in the pipeline or passageway (10) restrictor means (46) so that in effect a venturi type throat (58) is created between the restrictor means (46) and the detritus surface, and this is coupled with the application of a sufficient pressure to the liquid to force it through said venturi effect area (58).

2. The method of claim 1, characterised in that the restrictor means (46) is moved progressively along the pipeline (10) as the detritus (12) is progressively removed.

3. The method according to claim 1 or 2, characterised in that the restrictor means (46) comprises tubes (46) which we inserted into the pipeline or passageway (10) and are inflated.

4. The method according to claim 3, characterised in that two inflated tubes (46) are used and these are located above the surface of the detritus (12), the venturi effect being created in the space (58) between the underside of the tubes (46) and the detritus (12).

5. The method according to claim 4, characterised in that the tubes (46) are everted into the pipeline or passageway (10).

6. The method according to any of claims 2 to 5, characterised in that the tubes (46) also form a fluid flow

stoppage device enabling the build up of a body of the liquid (14) of sufficient head (56) to cause the liquid to flow through the venturi area (58) at high velocity to erode and disturb the detritus (12).

7. The method according to any one of the preceding claims, characterised by sucking up the disturbed detritus (12) and delivering it to a separator (38) in which the detritus (12) is separated out from the liquid (14), and this liquid (14) is returned to the pipeline or passageway downstream of the venturi area (58).

8. The method according to any one of the preceding claims, characterised in that liquid (14) is returned from the downstream side of the venturi area (58) to the upstream side by a return pipe (48) and pump (50).

9. The method according to claim 8, characterised in that the return pipe (48) extends past and is supported by the restrictor means (46).

10. The method according to any preceding claim, characterised in that the detritus (12) is pre-loosened by pulling a plough device (24) therethrough.

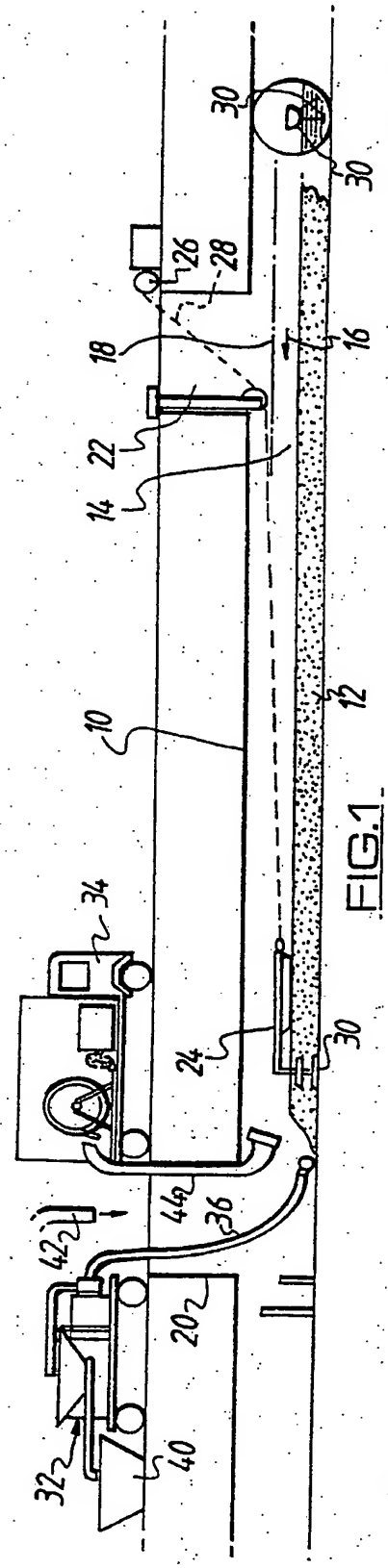

FIG.1

FIG.1A

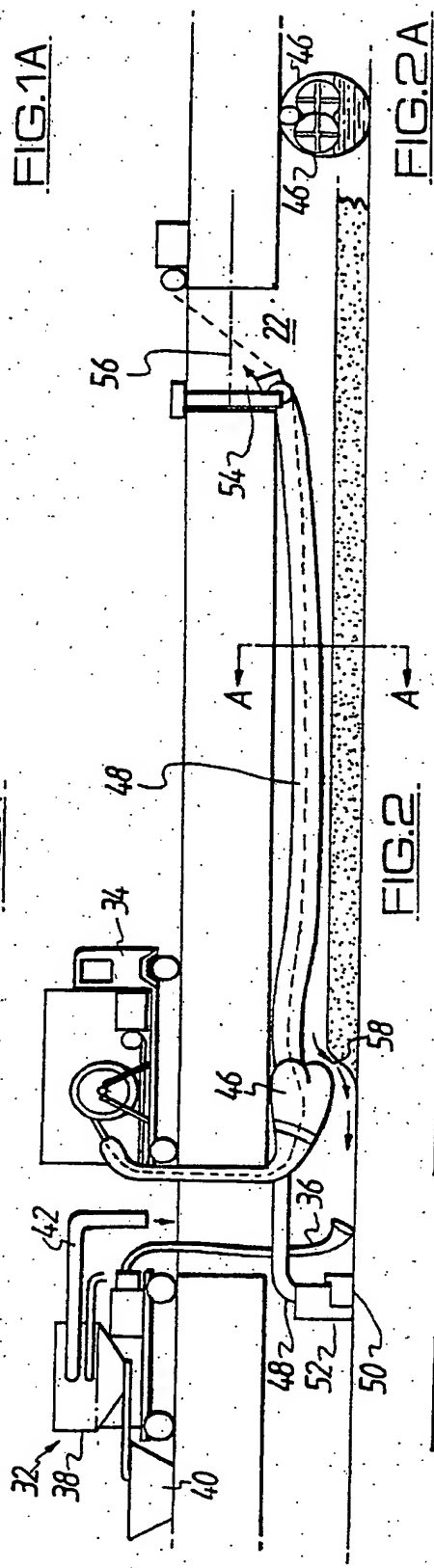

FIG.2

FIG.2A

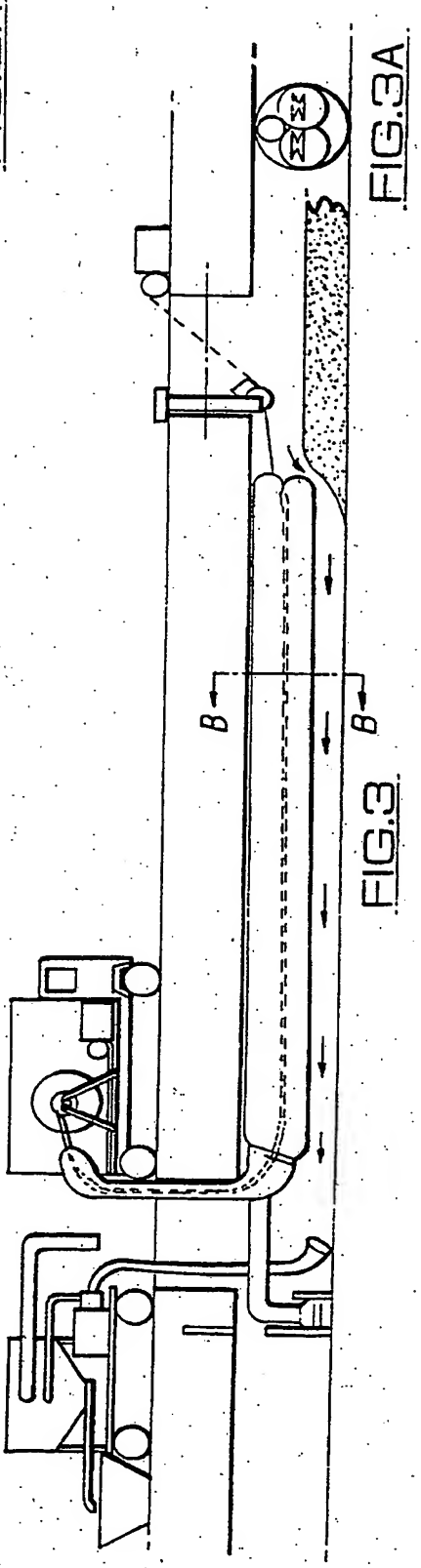

FIG.3

FIG.3A

INTERNATIONAL SEARCH REPORT

Inte mal Application No
PCT/GB 93/02007

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 E03F9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 E03F B08B

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	DE,A,31 02 738 (BAUMANN & BURMEISTER ...) 2 September 1982 see the whole document	1,3,6-8 2,10 4
Y A	FR,A,2 297 378 (MASUDA SENICHI) 6 August 1976 see page 4, line 16 - page 7, line 12; figures	2 5
Y	DE,C,34 19 811 (KUPCZIK) 5 September 1985 see column 3, line 46 - line 68; figure 1	10
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☐ Further documents are listed in the continuation of box C.

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6 December 1993	22 -12- 1993

Name and mailing address of the ISA	Authorized officer
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Information on patent family members

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